THE NEWSKAH CREEK FISH TRAP COMPLEX

GRAYS HARBOR, WASHINGTON

by

Randall Schalk and Greg C. Burtchard

Report submitted to the U.S. Army Corps of Engineers,
Seattle District, in partial fulfillment of Contract No. DACW67-97-D-1010,
Delivery Order No. 7

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October 2001

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The technical findings and conclusions in this report do not necessarily reflect views or concurrence of the sponsoring agency.

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October 2001

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EXECUTIVE SUMMARY

In the early 1980s, the Seattle District, U.S. Army Corps of Engineers conducted an archaeological reconnaissance for disposal of dredged material near Aberdeen, Washington. This reconnaissance resulted in the discovery of a series of intertidal wood stake alignments interpreted to be the remains of Native American fishing weirs or trap features. Located on the left bank of the Chehalis River between the mouth of Newskah Creek and Rennie Island, the site was designated 45GH73. Corps archaeologists collected a sample of the wooden stakes, initiated analyses of aerial photographs of the site, and carried out a search of ethnographic and archaeological literature pertaining to traditional Northwest Coast fishing weirs and traps. An alternative site was eventually selected for disposal of dredge sediments and, consequently, funding was not available to complete documentation of the site or prepare a report describing 45GH73 and the unusual features it contains.

In May of 1999, the Seattle District contracted with International Archaeological Research Institute, Inc. (IARII) to conduct a reconnaissance of the site, prepare a report describing the results of previous work at the site, and evaluate the site's eligibility for the National Register of Historic Places. This report describes the results of these investigations.

Fieldwork was aimed at three primary objectives: survey of the entire site area, preparation of a preliminary site map, and recovery of wood stake specimens for dating. Because of its position deep in the intertidal zone, access to the site is only possible during the lowest tides of the year. Reconnaissance of the site, therefore, was undertaken during hours of low tide over a four-day interval between June 12 and June 17, 1999. This reconnaissance revealed that the site is much larger than estimated in 1981 but also that it contains a wider range of stake alignments than previously described. In addition, radiometric dating of four wood stakes demonstrated multiple intervals of feature building or maintenance during the last millenium.

Mapping of the site, accomplished using a chain and compass technique and aerial photogrammetry, documented approximately 170 split cedar stake alignments and 7 sets of pilings. Historic maps and informant testimony indicate that the pilings are the remains of commercial fish traps that were used in the late 19th century. The stake and piling features extend along the mudflats from the mouth of Newskah Creek westward for 1600 m, expanding the estimated site area from 5 to roughly 80 acres of the lower intertidal mudflats. Erosion events since 1981 have apparently exposed substantial new areas of stake alignments, especially over the western portion of the site.

Stake alignments are highly variable in their orientation relative to tidal movement, relationships to other alignments, the spacing of individual stakes within them, and other attributes. Without a large series of radiocarbon dating and detailed recordation and analysis of feature attributes, interpreting much of this variability lies beyond the reach of the present project. Deciphering exactly how these alignments relate to one another functionally is complicated by the fact that the site appears to be a palimpsest of multiple and overlapping episodes of building and maintenance spanning an interval of 1,000 years or longer.

In the case of several V-shaped stake alignments, it is possible to infer contemporaneity of intersecting alignments. Such features appear to approximate ethnographically described fish traps in which the two wings of the V funneled fish into a basket trap. Based on what appear to be metal tool cut marks on a wood stake collected from one very large and well preserved cluster of V-shaped alignments, it appears that such fishing facilities were still used at this site after metal tools became available.

Four wood stakes that were collected in 1999 were submitted for radiometric dating. These samples yielded age estimates of 610 ± 50, 950 ± 50, 600 ± 60, and 1040 ± 50 ^{14}C years B.P. The two older dates derived from samples in the deepest part of the intertidal zone whereas the youngest samples are from the inland edge of the alignments. This pattern is intriguing relative to questions of seismic subsidence and interseismic uplift, but the series of radiocarbon dates is too small to draw conclusions of this nature.

Both the aboriginal fishing structures and the late 19th century commercial fish traps seem to have operated on very similar principles. During their spawning migrations, anadromous fish are delayed for significant periods of time around the mouths of their natal streams where they wait for the onset of appropriate spawning conditions and acclimate to the change from marine to freshwater environments. Their movement during this interval seems to favor lower energy environments such as sloughs, side channels, and shallows that allow minimization of energy expenditures. Low tides in these places tend to further concentrate fish, making them highly vulnerable to facilities that obstruct movement into deeper water on the outgoing tide. All of the fishing-related features documented during the present study probably operated on the principle of ebb tide stranding.

The report concludes with a discussion of future research directions and management recommendations. This site is clearly quite exceptional in terms of its size, complexity, and integrity. It is unequivocally capable of yielding information important for addressing one of the central research issues in Northwest archaeology—the developmental history of salmon fishing technology. Therefore, the site appears to be eligible for the National Register of Historic Places under Criterion D and is worthy of being managed for its potential scientific, educational, and interpretive values.

ACKNOWLEDGMENTS

The authors would like to express their sincere appreciation to several individuals who contributed to the completion of this project. David Rice, archaeologist for the Seattle District Corps of Engineers, offered advice and support to the effort and also successfully located historical maps showing the locations of commercial fish traps. His commitment to seeing the Newskah Creek site data properly reported was instrumental in making this project a possibility. Jacqui Cheung, Eric Gleason, and Zachary Schalk served as field technicians and each contributed a number of uncompensated hours of labor to the field effort. For production of this final draft report, the authors gratefully acknowledge Gail Murakami and Kathy Harter.

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1. PROJECT SCOPE AND BACKGROUND

1.1 INTRODUCTION

In the early 1980s, the Seattle District, U.S. Army Corps of Engineers conducted an archaeological reconnaissance for a proposed dredged material disposal site near Grays Harbor, Washington. During inspection of a locality on the left bank of the South Channel of the Chehalis River between the mouth of Newskah Creek and Rennie Island, the Corps archaeologists found numerous intertidal wood stake alignments that were identified as the remains of a large complex of Native American fishing weirs or trap features. They collected a sample of the wooden stakes, initiated analyses of aerial photographs of the site, and carried out a search of ethnographic and archaeological literature pertaining to traditional Northwest Coast fishing weirs and traps. An alternative site was eventually selected for disposal of dredged sediments and, consequently, funding was not available to complete documentation of the site or prepare a report describing 45GH73 and the unusual features it contains.

In May of 1999, the Seattle District contracted with International Archaeological Research Institute, Inc. (IARII) to conduct a reconnaissance of the site and prepare a report describing the results of all previous work at the site. Cascadia Archaeology was retained as a subcontractor by IARII to implement the project as a joint effort. The objective of this project was to comply with the National Historic Preservation Act, Engineer Regulation 1130-2-540 (Stewardship), and Dredging Guidance Letter 89-01 from HQ U.S. Army Corps of Engineers. Task elements included a survey of the site, mapping of the wood stake features, and collection of stake samples for radiocarbon dating. The remainder of this report presents background information, describes the methods and results of this study, and sets forth recommendations for the management of the site.

1.2 ENVIRONMENT

The study area is located at the mouth of the Chehalis River on the upper end of Grays Harbor (see Figure 1). Rennie Island separates the North Channel, which is the main channel of the Chehalis, from the South Channel, a shallow tidal slough. These two channels connect to deep water near the entrance to the harbor. The project area lies along the left bank of the South Channel between the mouths of Newskah and Chapin creeks. During very low tides (i.e., -3 ft), extensive areas of mudflats are exposed in the harbor. At such times, the width of the tideflat along the south shore of South Channel ranges from 200 to 400 m. The upper part of the bay has a muddy bottom.

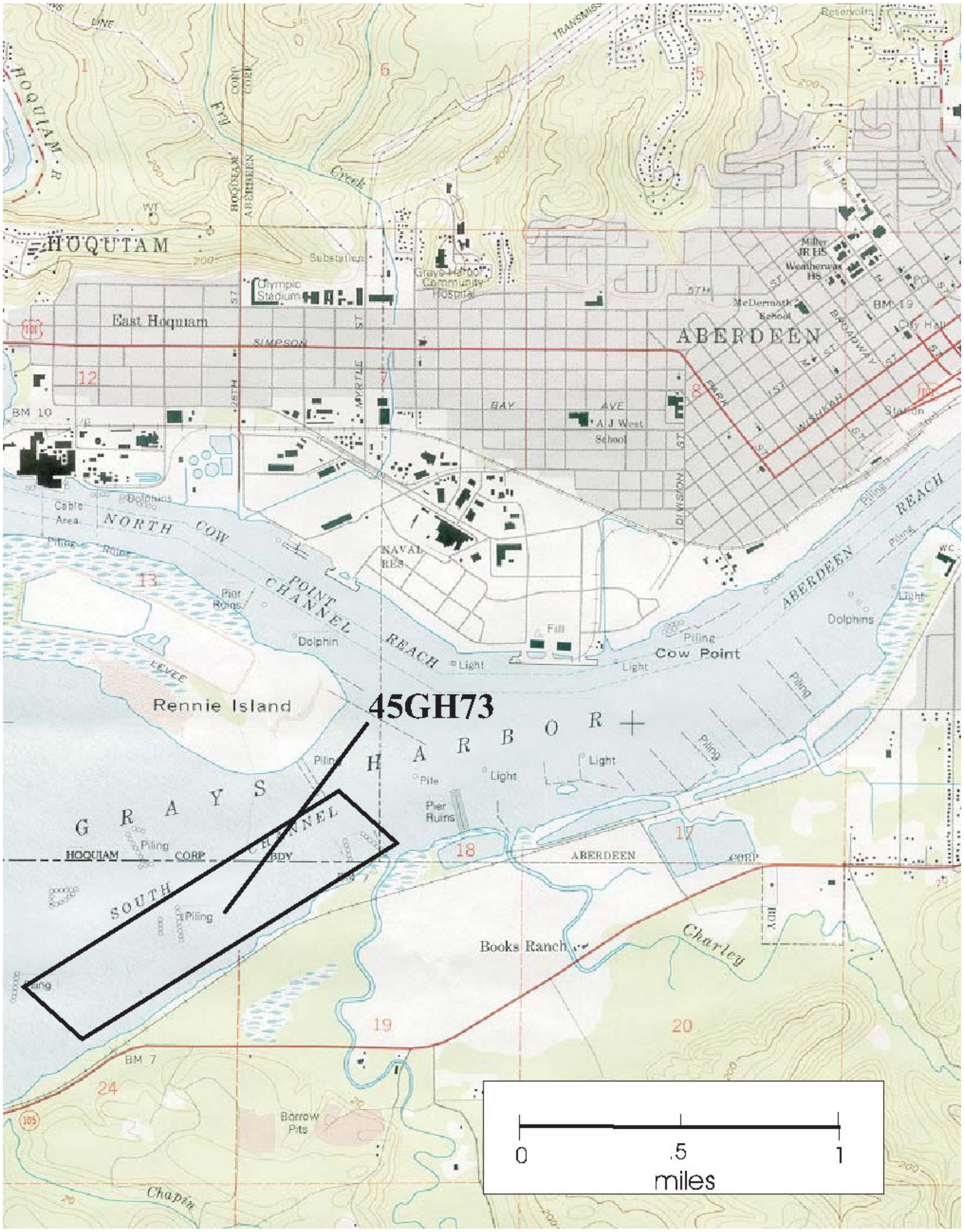

Figure 1. Vicinity map of Site 45GH73, the Newskah Creek Fish Trap Complex, Upper Grays Harbor (USGS Aberdeen, Washington; 7.5 minute series).

Grays Harbor is the estuary for the Chehalis as well as the Hoquiam and Humptulips rivers. In its lower valley, the Chehalis and its tributaries flow through a relatively low relief landscape. To the south and east are low rolling hills; on the north, the Wynoochee and Satsop rivers join the Chehalis after flowing off the south slopes of the Olympic Mountains. Precipitation is highly variable in this general region but is between 80 and 90 inches per year in the vicinity of Aberdeen.

Bedrock geology of this general area is comprised of basalts overlain by sedimentary rocks, both of which were formed on the floor of the ocean during the Eocene. Much of the surficial geology is dominated by glacial till outwash and recent alluvium. When ice filled Puget Sound during the glacial maximum, the Chehalis River drained a much larger catchment area than it does today. This accounts for the substantial disparity between the modern river channel and its oversized valley.

The project area is in a region that has been subjected to seismic events of large magnitude during the interval in which the fishing facilities were in use. In recent years, a substantial amount of research has been directed at the collection and analysis of geological evidence for large Holocene earthquakes along Washington's outer coast (Adams 1992; Atwater 1987; Atwater et al. 1991; Atwater et al. 1995, Atwater and Moore 1992; Bucknam et al. 1992; Jacoby et al. 1992; Hutchinson and McMillan 1997; Logan et al. 1998; Mathewes and Clague 1994; Karlin and Abella 1992; Schuster et al. 1992, and others). This research has provided extensive evidence for changes in land levels and tsunamis along the Pacific Coast's Cascadia subduction zone. Earthquakes of magnitude 8 or larger have caused sudden subsidence events followed by the deposition of sand layers that are interpreted as having been laid down by surges of water. Geologic evidence for such events has been reported for Willapa Bay and Copalis River (Atwater et al. 1995:2) as well as for a location only a few miles upstream on the Chehalis River across from Cosmopolis (Lawr Salo, personal communication). During excavation of a fish migitation slough at the latter location, hundreds of buried spruce stumps were exposed at a depth of 1.5 m below surface. Considering the intertidal position of the Newskah Creek site and its location at the head of Grays Harbor, it is likely that these seismic events have considerable relevance to fishing facilities that were operated in this area in past centuries.

The Chehalis River supports runs of spring and fall chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch)*, and chum salmon *Oncorhynchus keta*) as well as steelhead (*Oncorhynchus gairdnerii*). Spring chinook enter the Chehalis from March through July; fall chinook follow from late July through mid-November (Phinney and Bucknell 1975:22:2). Coho salmon runs enter the drainage from September through February with the earlier portion of this run spawning throughout the basin and the later segment using lower portions of the basin and its tributaries (Phinney and Bucknell 1975:22:2). Chum salmon enter the Chehalis between early October and mid-December (Phinney and Bucknell 1975:22:3). Several small creeks that enter Grays Harbor in the immediate vicinity of the project area support at least small runs of coho salmon and

Newskah Creek has runs of both coho and chum (Phinney and Bucknell 1975:22:4003). The salmon gill net fishery extends along both channels around Rennie Island and at least four miles up the Chehalis (Department of Natural Resources Vol. 4 1974).

In addition to salmon, a number of other fish species may be found in Grays Harbor. These include coastal cutthroat trout (*Oncorhynchus clarki clarki*), steelhead trout (*Oncorhynchus mykiss*), eulachon (*Thaleichthys pacificus*), white sturgeon (*Acipenser transmontanus*), green sturgeon (*Acipenser medirostris*), Pacific lamprey (*Lampreta tridentatus*), English sole (*Pleronectes vetulus*), Northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea pallasi*), and starry flounder (*Platichthys stellatus*) (Pacific States Marine Fisheries Commission 1996). Phinney and Bucknell (1975:22:1) describe Grays Harbor as "an important marine area providing an essential fresh-salt water conversion zone and feeding ground for juvenile salmonids produced in the basin." Marine species that are periodically concentrated in the western part of the harbor also serve as a food source that attracts adult salmon into the harbor. No herring spawning areas are shown for this particular area of Grays Harbor although there is a small locality used by herring in the southern part of the lower bay (Department of Natural Resources 1974). A sport fishery for sturgeon extends along the southern portion of Grays Harbor, encompassing the area around Newskah Creek and the South Channel (Department of Natural Resources 1974).

Other potential food resources available in the area include shellfish and waterfowl. Shellfish resources are most productive in the lower portion of Grays Harbor where a variety of native hardshell clam species as well as crab (*Cancer magister*) are found. The sluggish waters of the vicinity of the project area provide habitat for mud-loving species including softshell mud clams. A major waterfowl area runs around the periphery of Grays Harbor and includes the site area.

1.3 ARCHAEOLOGICAL BACKGROUND

Relatively few large-scale archaeological studies have been conducted along the southwest coast of Washington. In 1947, Richard Daugherty carried out an archaeological survey of the coast of Washington but it is unclear whether this included the margins of Grays Harbor (Daugherty 1948). In the early 1970s, Washington State University conducted excavations at the Minard site, a large shell midden located near Oyhut (Roll 1974). This project probably represents the most intensive investigation that has occurred in this general area. Most other archaeological studies have been small-scale reconnaissance level efforts that have been carried out in the context of cultural resources management efforts.

In 1975 for instance, Seattle District Corps of Engineers archaeologist David Munsell surveyed three dredged material disposal sites in the vicinity of Hoquiam and Aberdeen but found no evidence of prehistoric archaeological remains (Munsell 1976a). One of the three localities surveyed (Area A) was an upland area between Newskah and

Charlie creeks. In 1980, anticipated changes in the use of the disposal area necessitated additional archaeological investigations at this same location. Backhoe trenches were used to search for buried cultural deposits but this effort also failed to identify prehistoric cultural remains (Munsell 1980). During a third investigation that took place during a low tide in June of 1981, Munsell examined an intertidal area slightly west of the mouth of Newskah Creek (see Appendix A). On this occasion, a large concentration of intertidal wood stake alignments was discovered that was designated the Newskah Creek Fish Weir (Site 45GH73).

One of the earliest descriptions of a fish weir in western Washington was of a large cross-channel structure that was operated on the Green River in south King County during the 19th century (Ballard 1957). Historical and ethnographic sources relating to this structure provide detailed descriptions of the construction of a kind of weir that was widely used along the streams of western Washington prior to their prohibition. This type of weir was constructed so as to entirely cross the channel at locations with suitable depths and is the type most commonly described in ethnographic accounts (e.g., Smith 1940:258-261; Waterman and Kroeber 1938).

In 1961, the Washington Archaeological Society found what was described as a weir lattice fragment from the Biederbost site, also known as 45SN100 (Nordquist 1961). From the illustration of this find, it may actually be a piece of a lattice panel. The type of weir described probably would be of the variety that extended across the river channel.

Munsell (1976b) reported the remains of a weir structure on Wapato Creek that were discovered in the Port of Tacoma's industrial area during dredging operations. Although portions of this structure were apparently destroyed by dredging, this weir may have extended entirely across the creek.

Fish traps that are constructed of rocks in the intertidal zone have been found in large numbers around the mouths of salmon streams in British Columbia (Pomeroy 1976). These are found over much of the British Columbia coast but are particularly common in central British Columbia. Instead of intercepting the migration of salmon migrating up streams, these traps were designed to capture fish that concentrate around stream mouths waiting for appropriate stream conditions (e.g., temperature) prior to proceeding to upstream spawning areas. During high tides fish school in areas behind rock enclosures that become impoundments during low tides.

University of Oregon archaeologists have carried out the most extensive investigations of intertidal fish weirs in the Pacific Northwest to date. Between 1993 and 1995, archaeological surveys in seven estuaries of the Oregon Coast recorded a total of 30 tidal weir sites (Byram 1998:202). These sites consist of alignments of wood stakes on mudflats and intertidal channel banks. As of 1998, 31 weir stakes from these estuary sites have been radiocarbon dated and the resultant dates document the usage of these features over the last 2,500 years (Byram 1998:204). Using this archaeological data base on weirs in conjunction with ethnographic descriptions of fishing weirs for the Northwest

Coast, Byram has developed a typology of weirs based on whether they depend on tidal action and relationship of the weir to the river channel and topography (Byram 1998:205). He notes that the majority of estuary tidal weirs are located on secondary channels, not along the main channel. In addition, it is noteworthy that many of the weirs located on secondary tidal channels are situated "…at the mouths of sloughs that drain almost completely during a moderately low tide." As will be discussed in a later section of this report, the Newskah Creek site conforms quite well with this weir locational pattern.

One of the most extensive investigations of a weir site was carried out at the Osprey Site which is located in the intertidal zone of the Coquille River estuary (Byram and Erlandson 1996). Mapping of this site revealed a complex of over 40 linear wood stake features distributed along 600 m of mudflats. Radiocarbon dates revealed that the features had been in use between 900 and 350 years B.P. The most recent weir or trap features are located at higher elevations within the intertidal zone, apparently due to subsidence induced by a seismic event. Byram and Erlandson identified three kinds of stakes from the weir features: stem (made from branches), split wood, and brush (small stem stakes that have not had their branches removed. Lattice fragments recovered at this site had mesh considerably smaller than would be required to take salmon, suggesting that these weir features may not have been used exclusively for salmon fishing. This study is apparently the most comprehensive investigation that has been carried out on a single intertidal fish weir facility on the Northwest Coast and it provides many important insights into this class of sites.

Sufficient data on tidal fishing structures have been accumulated along the Northwest Coast that comparative studies are possible. Moss and Erlandson (1998), for example, have examined trends in the radiometric dates for Northwest Coast fishing features and have identified contrasts in the age of such sites between the southern and northern coast. They suggest that the lack of dates older than about 2,000 years on the southern Northwest Coast may be the result of regional subsidence processes.

1.4 ETHNOGRAPHY

A detailed ethnographic overview for the Grays Harbor area has been completed by James and Martino (1986) for the U.S. Army Corps of Engineers, Seattle District. That study reviews written accounts of the first white explorers who visited the area and examines the complicated relationships between modern tribes and the native people who occupied the Grays Harbor area. The discussion here is limited to briefly summarizing those aspects of the ethnographic record that apply directly to the Project Area for the present study, that are germane to fishing technology, or that provide historical contexts for understanding the archaeological features that are the subject of the present study.

Ethnographic sources indicate that salmon were the primary fish resources, but a variety of other fish was exploited in Grays Harbor and the rivers and creeks that are tributary to the Harbor. These include several species of salmon, sturgeon, lamprey eel, flounder, and herring. Although fish weirs and traps may have been used in some regions of the Northwest for a wide range of fish species (Byron 1998), the ethnographic sources for Grays Harbor seem to consistently mention these devices in association with salmon (James and Martino 1986).

Shellfish collecting is documented in ethnographic sources for a number of specific localities within Grays Harbor but apparently not for the vicinity of Newskah Creek. During fieldwork for the present project, the only shellfish observed in the Newskah locality was a soft-shelled mud clam of unidentified species.

Most of the creeks that enter this portion of Grays Harbor have Indian settlements associated with them. Although Newskah Creek is not mentioned as a place named in historical sources as the site of Indian fish traps, Charles Wilkes (1845) identified an Indian village as being located in this vicinity in 1841. A few years later, James Swan (1857:353 [James and Martino (1986:42]) saw Indians camping on what was apparently the north side of Rennie Island. Numerous non-Indian fish traps and gill-netters operated in this locality in the late 1800s (James and Martino 1986).

Informants interviewed by James and Martino (1986:40, 44) reported the remains of fish traps at the mouths of O'Leary Creek, the south end of South Bay at Bay City, in the North Bay area of Grays Harbor in the vicinity of Grass Creek, and near Oyhut. Although the ethnographic sources mention traps in locations where they would probably have been constructed in the intertidal zone, descriptions of how these were constructed and details of the operation are apparently lacking.

James and Martino cite Fried (1950) and Adamson (1927) to the effect that fish traps could be used with the permission of the builder. Adamson reported that "Often several people or groups constructed a fish trap, or a trap was constructed for a particular village or group of people and all the people shared in using the trap (James and Martino 1986:56)."

Ethnographic interviews carried out by James and Martino in 1985 (1986:38) indicated that [the south shore of Grays Harbor between Charley Creek on the east to Stearns Point on the west] "was important for fishing, berry and plant gathering and elk hunting into the 1900s."

1.5 HISTORY

Few historical details about the historic period trap fishery in Grays Harbor were located during the present project, but it may be assumed that this fishery was broadly similar in its nature and development to its counterpart on the Lower Columbia River. The first salmon trap on the Columbia River was built on Baker Bay in 1879 and others soon followed (Cobb 1931:422). Historical records on the number of cases of salmon canned in the Grays Harbor area begin in 1878 (Cobb 1931:560).

Craig and Hacker (1940:149) cite Victor (1872) that the first salmon traps on the Columbia were built in 1853 at Oak Point. These authors (1940:170) distinguish two types of fish traps on the Columbia. The wooden trap was the earliest form and became important with the growth of the canning industry after about 1868. These were used primarily from the lower end of Sauvies Island to the mouth. Craig and Hacker describe these structures as a "modification of the pole-and-brush weirs which were used by the Indians before the arrival of the white men." The second type was the pile-and-web (pound net) variety. This type of trap was first used in 1879 and had totally replaced the wooden traps by about 1894. By 1886, there were 154 traps on the Columbia, the majority of which were in Baker Bay. The traps were only surpassed by the drift gill nets in terms of their percentage of the total Columbia River salmon catch by all types of gear. The species harvested included chinook, coho, steelhead, chum, and sockeye salmon (Craig and Hacker 172-3). Also, shad were being caught in abundance by 1893 although of little or no economic value (Craig and Hacker 1940:202). Craig and Hacker (1940:171) report that

> "At the beginning of the trap fishery most of the piling was hand driven and much of it was removed for the winter after the end of the fishing season. The piling is now all driven by power operated piledrivers and it is left in continuously. Larger piling and sturdier construction is used in the modern traps than in those built during earlier years."

Competition and conflict over salmon between commercial trap fishermen and gillnet fishermen were inevitable. An additional factor that weighed against fish trapping was that the structures were considered navigational hazards. These factors apparently resulted in the State of Washington outlawing the trap fisheries in 1935 (Craig and Hacker 1940:172).

2. METHODS

2.1 FIELD METHODS

Fieldwork was carried out at the Newskah Creek site (45GH83) during the low tides between June 12 and 17, 1999. An archaeological team that varied in size from three to five individuals conducted mapping and documentation activities during this interval. Randall Schalk and Greg Burtchard directed the fieldwork. The field crew included Eric Gleason, Jaqueline Cheung, and Zachary Schalk. The senior author revisited the site on August 11, 1999 to do additional photodocumentation of the wood stake features.

The pre-fieldwork plan for mapping of the wood stake features envisioned heavy reliance on photogrammetry. In terms of both efficiency and accuracy, this approach seemed to offer the best method available for mapping features at this site. A large number of linear wood stake features could be clearly identified on the high quality aerial imagery obtained by the Corps during a fly-over scheduled during low tide in 1981. Following their initial visits to the site, Corps archaeologists had initiated the preparation of a Mylar overlay onto which visible stake alignments were traced. Because this effort was incomplete, the initial step in preparing for the present field effort involved finishing the overlays for use in the field for "ground-truth" checking. Large-scale photocopies of the overlays were then made from the overlays for use in the field.

A feature form specifically designed to record weir attributes (types of stakes, spacing, dimensions of stakes, etc.) was prepared in advance of fieldwork to be used to describe the individual features. The intent was to assign numbers to all features visible on the aerial images, locate each feature on the ground, describe it on the feature form, and photograph it. After the first day of work, however, it was clear that this approach would not be practical given surface conditions, limited observation time, and the unexpectedly high number and complexity of individual stake alignment features encountered at the site.

Initial reconnaissance of the general locality during the first hours of daylight on June 12, 1999 revealed that the site is considerably larger than originally estimated. Instead of being 550 m long as described in the 1981 site form, the distribution of stake alignments was found to extend for a distance of approximately a kilometer and half westward from the mouth of Newskah Creek along the South Channel. An extensive series of stake alignments was found to the west of those originally described, but unfortunately this area was not covered by the 1981 aerial photo imagery. Further complications that thwarted implementation of the pre-field plan for feature mapping and recording were the brevity of access to features and the difficulty of movement across the site. Even on the lowest tides of the year, many stake alignments are in the lowest part of the intertidal zone where they are exposed very briefly—for a half hour or less—making the kind of documentation initially envisioned a physical impossibility for a small crew. Adding to these challenges, were the very difficult conditions of pedestrian access to the site across soft, often knee-deep mud that in places approximates "quicksand".

Faced with new and unanticipated conditions, it was clear that any type of on-the-ground mapping of the *entire* site would not be possible within the scope of the present project. Furthermore, production of a detailed and precise map of only a small portion of the larger site seemed to be ill-advised considering that no additional follow-up studies are planned. To maximize the scientific and management value of the work that could be accomplished within the project scope, a compromise strategy was developed to map as much of the unphotographed western portion of the site as possible within the field time available to us. For the eastern portion of the site, where aerial photo coverage existed, the revised mapping strategy involved primary reliance on photo imagery for documentation of the feature array. The compromise strategy, therefore, included a combination of on-the-ground mapping as the primary method of documenting the western end of the site, coupled with reliance on existing aerial photo imagery to delineate features at the eastern end. This approach provided the greatest promise for successful production of a preliminary plan map of most of the site features, plus a generalized view of their spatial extent and configuration.

Accordingly, compass and chain mapping techniques were used to document the newly discovered western cluster of features, and an 80-m wide control section of the eastern cluster. A baseline was established along the long axis of the site (parallel to the channel, southwest to northeast) using pin-flags placed at 50-m intervals (see foldout map—Figure 2). These pin-flags were labeled and used as reference points for chain and compass feature mapping. To maximize the rate of mapping with a small team under difficult field conditions, cork-screw type steel dog-tethering pins were used as chain holders. These devices allowed mapping of up to three areas of the site simultaneously. The baseline pin-flags were used as reference points for the radial mapping technique. In addition to mapping wooden stake features, prominent, permanent features (e.g., pilings) were also mapped relative to the baseline reference points. These also were recorded with GPS equipment (see Appendix B). These reference points should allow correlation of the map with aerial photographs that may be obtained in the future.

Because there are thousands of wood stakes on this site, mapping focused on the ends of stake alignments, intersections, gaps, and flex points. A three-part distinction was used during field mapping to characterize differences in stake spacing within individual alignments (i.e., stakes less than 10 cm apart, stakes 10 to 50 cm apart, and those in discernable alignment but separated by visible gaps of over 50 cm). Because most features fell within the less than 10 cm to 50 cm range, a two-part distinction (less than, and greater than, 10 cm spacing) is shown on the overview site map (Figure 2) as well as in two enlarged subarea maps of the site (Figures 3 and 4).

It is important to note that, even for the eastern feature cluster for which aerial imagery was available, it was difficult to correlate photo images with features visible on the ground. Some of the largest, most pronounced alignments observed in the aerials could be recognized, but many other features that were plainly visible on the tidal flats could not be linked to the aerial imagery at all. It was initially thought that the aerial images might simply be lacking in sufficient detail to be as useful as hoped. However, subsequent observations suggested that surface exposure of features across the site was much different in 1999 than in 1981. This conclusion is discussed at greater length in a later section of this report. It appears that many more features are now exposed as a result of recent sediment erosion across much of the site—erosion that is most pronounced on the lower western half. The new "ground-truth" map of the 80-m strip in the eastern site cluster indicates that additional features not visible in 1981 are now exposed in the part of the site nearest Newskah Creek as well (see red versus black feature alignments on map Figure 4.

In addition to the changes in mapping strategy, it was also necessary to simplify the original plan for documenting individual stake alignments. Instead of preparing a feature form that included several attributes for each stake alignment, an effort was made to photographically document the range of variation observed. Given that the number of alignments estimated for the site in 1981 underestimated those observed in 1999 by a factor of three or four, this too seemed like the best alternative.

Beyond generating an overall plan map for the site and documenting the variability in features present on it, a third goal of the effort was to gain some insight into the age of the site. At the time it was originally recorded, the site was considered to be protohistoric/historic in age and, although a number of wood samples had been collected in 1981, none had been radiometically dated. The lack of detailed provenience information on the samples collected in 1981 limited the value of those specimens for dating.

In order to improve chronometric control, a total of ten weir stakes was collected from six site locations for radiocarbon assay. Samples were drawn from widely dispersed locations in order to sample the landform as uniformly as possible within the bounds of a limited project. Four weir stakes were collected from three locations in the western feature cluster as shown on map Figure 2 (Sample Locations 1, 2 and 3). Sample location 1 was located near the site's southernmost, inland margin. Sample Locations 2 and 3 were situated near the water's edge at maximum low tide. In the eastern feature cluster, six withes were collected from three locations (Sample Locations 4, 5 and 6 on map Figure 2)—one inland, one at the water's edge, and the third from a westerly location approximately central to the feature cluster north to south.

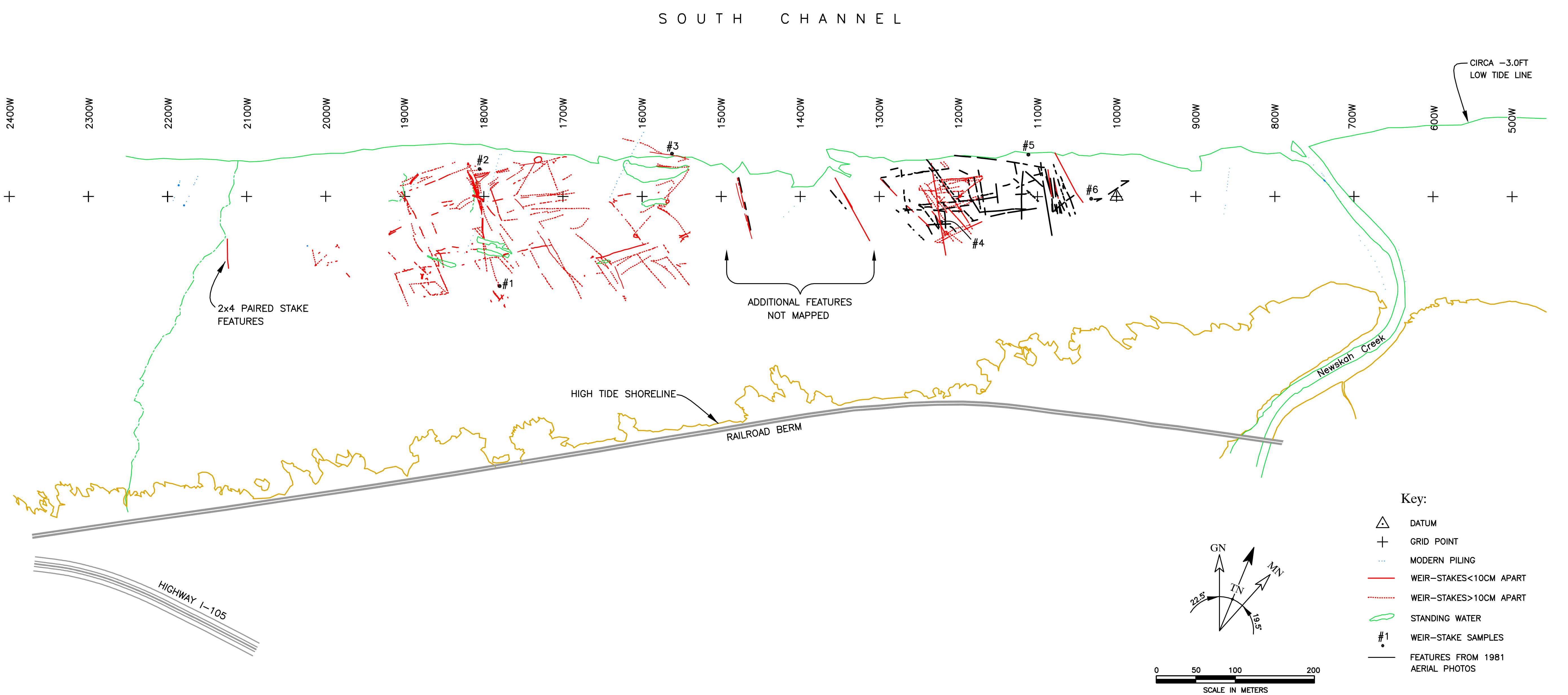

Figure 2. Overview map of the Newskah Creek Fish Trap Complex.

Figure 3. Western section of the Newskah Creek Fish Trap Complex.

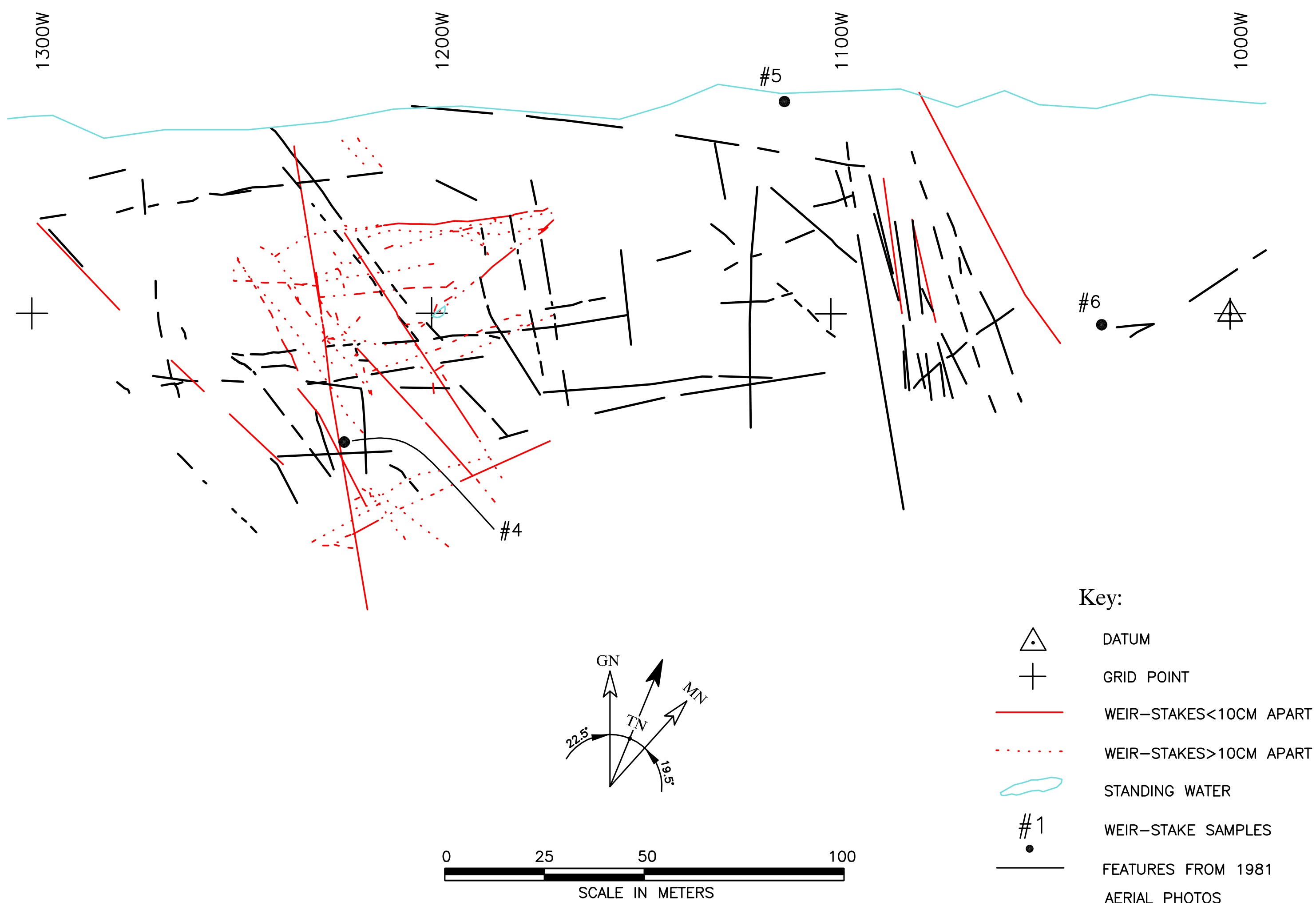

Figure 4. Eastern section of the Newskah Creek Fish Trap Complex.

It should be noted that the vast majority of weir stakes at 45GH83 were split western red cedar. In order to avoid the possibility of sampling old interior wood, unsplit, branch wood cedar samples were collected from all six locations. At four sample locations (Locations 3, 4, 5, and 6) paired samples of branch and split cedar were collected to provide for the option of examining the age variance between branch and interior wood. Because present project funds were sufficient for only four radiocarbon age estimates, branch wood samples from sample locations 1, 3, 4, and 5 were submitted, returning results shown on Table 1 (see Section 3.9 for detailed radiocarbon data). The remaining samples have been treated as described below and have been returned to the U.S. Army Corps Engineers, Pacific Northwest District for long-term storage.

Table 1. Weir Stakes Collected from the Newskah Creek Site

Sample Location	Site Cluster	Description
1	Western	Single branch wood weir stake collected from the southwest inland site margin at ca. 1800 west. No apparent cut marks. wood sample returned conventional ^{14}C age of 550±50.
2	Western	Single branch wood weir stake collected near the northwest channel margin ca. 1800 west at maximum low tide; weathered apparent ax sharpening marks at distal end.
3	Western	Roughly central site location near the channel margin ca. 1550 west at maximum low tide. Paired branch and interior split cedar sample. Clear, multiple stone tool cut marks are visible on the distal end of the branch wood stake. Branch wood sample returned conventional ^{14}C age of 930±50.
4	Eastern	Paired branch and split cedar sample from an interior location near 1200 west. Sample feature is readily visible on 1981 aerial photographs. Branch wood sample returned conventional ^{14}C age of 530±60.
5	Eastern	Paired branch and split cedar sample collected from the northeastern channel margin near 1100 west at maximum low tide. Stone tool cut marks are visible on the distal end of the branch wood stake. Branch wood sample returned conventional ^{14}C age of 960±50.
6	Eastern	Paired branch wood and split cedar sample collected from an approximate site central location (north to south) near 1000 west.

2.2 LABORATORY METHODS

All of the wood samples collected from the Newskah Creek Site were sent to IARII laboratory facilities in Honolulu for documentation prior to submittal of selected samples to Beta Analytic, Incorporated for radiocarbon analysis. Laboratory procedures in Honolulu involved photo documentation, underwater immersion to gradually remove saline water from the wood, drying, and wood species identification. Immediately following arrival at the lab, the water-saturated withes were photographed then immersed in a saltwater holding tank to minimize cell damage. The salt fraction in the immersion tank was gradually reduced over a thirty-day period until the withes were immersed in, and saturated with, fresh water only. Following the salt removal process, stakes were removed from the tank, remaining barnacles brushed off (most had fallen off naturally as the water changed from saline to clear), and the stakes covered with muslin and laid out on screens to dry in a closed, air-conditioned room.

After drying, selected samples of branch wood and split interior wood stakes were cut and examined by Gail Murakami in IARII's Wood Identification Laboratory. All samples, both branch and split wood, were identified as *Thuja plicata* (western red cedar). A sample of four branch wood specimens was then selected for radiocarbon dating. Sections of the well-preserved (below ground) portions of the specimens were submitted for assay to Beta Analytic, Inc.

The wood specimens collected by Corps archaeologists at the site in 1981 were borrowed for examination and documentation. Methods for treatment of these specimens following their retrieval are not known but they had been wrapped in plastic and placed in large cardboard tubes. Although the wood remains themselves are in remarkably good condition, the aluminum tags that were wired to these specimens were so heavily corroded that several were no longer readable. Descriptions of all stakes collected in 1981 are presented in the following chapter.

3. SURVEY RESULTS

3.1 GENERAL SITE DESCRIPTION

The site is located at the mouth of the Chehalis River on a slough behind Rennie Island that is known as South Channel (see Figure 2). Movement of water through this slough is sluggish, driven more by the tides than flow from the Chehalis River. The channel along this reach is shallow with maximum soundings of 10-12 ft. On a 3-ft. minus low tide, the channel at the west end of the site is separated from the high tide line by a 200 m-wide mudflat. The width of these exposed mudflats expands to over 400 m at the west end of the site. Sediments are much firmer in the deeper part of the intertidal zone where the stake alignments are located but to access these on foot, one has to cross very soft, deep mud that parallels the shoreline in the upper tidal zone.

Most of the wood stake alignments lie in a 1,600-m-long band in the lower tidal zone and this band varies in width from about 130 m at the east end of the site to about 200 m at the west end. Scattered along this same section of the slough and among the wood stake features are seven groups of pilings that are oriented at or near normal angles to the slough channel at low tide.

Wood stake features appear to be essentially continuous throughout the length of the site diminishing at the western and eastern margins. However, two areas of particularly high feature density are situated in the east and west-central parts of the site. The eastern high-density area is that which was visible on the 1981 aerial photograph and originally documented as Site 45GH73. The second high-density area lies ca. 600 m west of the original site center.

On the ebb of a 3-ft. minus tide, some stake alignments extended into the water where they could not be mapped. Additional features may be present on the opposite side of the channel along the shore of Rennie Island. That area was not examined during the present project as access to the island is only possible by boat. Pilings are present along the opposite side of the South Channel on Rennie Island that may be the remains of historic period commercial fish traps (see discussion of piling features below).

Surface exposure of features across the site was apparently much different in 1999 than in 1981. An estimated 50 stake alignments in an area of about five acres were noted in 1981 whereas the mapping effort in 1999 suggests that roughly 170 features are distributed over about 80 acres (32 hectares). This disparity seems to be the result of recent sediment erosion across much of the site. The extent of this erosion may be most pronounced on the lower western portion of the site inasmuch as many features in that area were apparently not observed at all in 1981. Stake alignments there were probably completely covered by mud that has been removed by erosion events during the subsequent 18-year interval.

The chain and compass mapping of the 80-m strip in the eastern site cluster (see Figure 4) provides a "ground truth" check that suggests many additional features that were not visible in 1981 aerials are now exposed in that part of the site as well. Despite high quality aerial imagery of this area showing well-defined stake alignments, it was generally difficult to correlate specific features on the ground with those in the air photo because so many more were visible on the ground. The overall impression is that one or more erosion events has dramatically altered the number of features visible on the site surface. High volume discharges through South Channel that could cause such erosion may be associated with major flooding of the Chehalis River.

3.2 DESCRIPTION OF FEATURES

Figures 3 and 4 provide more detailed representations of the mapped features for each of three subareas of the site. These figures reveal complex and varied patterns in their orientation relative to the channel and one another, length of individual alignments, and spacing of stakes within alignments. These dimensions of variability are considered individually in the sections that follow.

3.2.1 FEATURE TYPES AND ORIENTATION

Alignments of stakes are considered in this section; the piling features and one other historic period feature are discussed in another section below. All of the alignments that were observed on the site are composed of rows of stakes that are arranged in straight lines. Although some of these rows wander from being perfectly straight lines most are quite straight. None that were markedly curved were noted. The alignments range from a few stakes extending for only a few meters to others that extend as much as 150 m long.

Based on their positioning relative to one another, at least four rather different classes of wood stake features can be distinguished. These four classes include simple linear, V-shaped, U-shaped, and obliquely convergent. The following discussion must be heavily qualified with recognition that it is rarely possible to know the extent to which the original elements of a structure are sufficiently intact to infer what it might have looked like when it was in use.

Simple linear alignments include those that have no obvious relationship to another alignment. Included here are alignments that may have others intersecting them but not in such a way that any functional relationship or contemporaneity can be inferred. For example, some alignments seem to pass *through* others and are constructed differently. Figure 5 illustrates an example of two stake alignments that intersect at roughly right angles and do not share a common pattern of manufacture. One consists of densely packed stakes in an alignment running perpendicular to the channel while the other is composed of much more widely spaced stakes arranged in a single row more or less parallel to the shoreline. The contemporaneity of such alignments is doubtful but without some chronological control this cannot be demonstrated.

Simple linear alignments are probably the most common type of stake features on the site. Many of these are roughly perpendicular to the channel but others are parallel to it or in a wide variety of other orientations.

A second class of features includes paired alignments that form a V. These *V-shaped alignments* might be further divided into two subclasses—those that occur as a single pair of stake rows in a V-pattern and multiple pairs of alignments arranged as nested Vs. Several examples of the first variety of V-shaped alignment are discernable in the inset maps of the site (see Figures 3 and 4) in the vicinity of 1200W and especially between 1600 and 1900W. Only a single example of the nested V-shaped alignments was recognized and this large and complex feature is quite exceptional in several respects. It is located at 1800W and is shown from different angles in Figures 6, 7, and 8. The wings of this feature consist of nine parallel rows of stakes along one side of the "V" and five along the other. Thousands of stakes are densely spaced along rows that extend from 50-75 m in length. At the ends of the wings and at the apex of the Vs, the stake rows converge. The opening of the V faces into the outgoing tide. This feature was unusual for having what appeared to be so many different alignments that are clearly integrated elements of a single structure. More often, it is quite difficult to infer relationships of different alignments to one another.

Although V-traps are mentioned in ethnographic literature, the specific construction attributes of this feature have apparently not been described previously. The other observation of interest about this feature is that it was probably built in the historic period. In contrast to the other stakes collected for dating, a stake removed from this feature proved to be the only one of those collected that appeared to have been sharpened with a metal axe. Given a probable historic age for this feature, and limited funding for radiometric dating, this sample was not submitted for dating.

U-shaped alignments consist of three alignments that are positioned so as to form the three sides of a rectangle or parallelogram. Features of this variety are distinguishable at the southwest end of the site between 1550 and 1900W (see Figure 9). These features may actually be V-shaped alignments that are positioned side-by-side. This interpretation may account for the fact that, in contrast to the V-shaped alignments, the openings of several of the U-shaped alignments seem to face the upland rather than into the outgoing tide.

Figure 5. Intersection of two stake alignments.

Figure 6. Stake alignments in V-shaped pattern.

Figure 7. View of nested V-shaped alignments looking northward from the middle of the south wings of the feature. South Channel is in the background.

Figure 8. Convergence point for south wing alignments of nested V-trap. View is to north from 1800W. Pilings are remains of late 19th century commercial fish trap.

Figure 9. Stake alignments in a U-shaped arrangement. View is to the east from 1750W.

The fourth class of alignments, *obliquely convergent*, includes those that are comprised of two rows of stakes that intersect at acute angles. Figure 10 shows one such feature in the eastern cluster of alignments. In describing fishing facilities in use at Shoalwater Bay in the early 20th century, Edward Curtis (1970:50) may have been describing features of this variety "made by arranging on the tideflats two long, converging lines of upright poles, which led fish into a cul de sac, where they remained as the tide receded."

The most meaningful point of reference for considering orientation of alignments is probably the channel of the slough inasmuch as the fishing facilities at this site are assumed to have been tidally driven. As is clearly evident in the site maps, the relationship between stake alignments and the channel of the slough cannot be characterized in any simple way. Some are roughly perpendicular to the channel, some parallel to it, and still others have intermediate angles (between 0 and 90 degrees). Some terminate at points of intersection, others cross each other as if they were unrelated elements of different structures.

Figure 10. Obliquely convergent stake alignments; view is to the north with South Channel in the background.

3.2.2 LENGTH OF ALIGNMENTS

The length of individual features is highly variable; the smallest alignments amount to just a few stakes arranged linearly over a few meters; the two largest alignments are between 120 and 150 m long; several other stake alignments are between 80 and 100 m long. Compared to tidal channel weirs in Oregon coastal estuaries that have stake alignments that are typically less than 40 m (Byram 1998:207), many of the Newskah Creek features appear to be of exceptional size. This may in part be accounted for by the fact that, while the South Channel is technically a secondary tidal channel, it is a very wide channel and, consequently shares characteristics with tide flat settings.

Many of the stake alignments that were mapped had gaps that may be related to preservation or these could be purposeful structural attributes. Some alignments that were mapped as distinct features are in all probability segments of longer alignments that have been eroded or crushed so that sections lack stakes protruding above the mud.

3.2.3 Spacing of Stakes in the Alignments

Many features are constructed of straight rows of individual stakes; some are constructed of 20-30 cm wide bands of stakes arranged in long rows; still others appear to contain paired rows of stakes. This variability probably reflects a variety of different construction techniques with functional and temporal implications that are presently not understood.

Stakes in some features are so closely crowded together that they actually touch each other and are difficult to count (see Figure 11). Such features would seemingly have created a wall of stakes that probably would present a serious obstacle to fish passage without any associated lattice panels. The majority of alignments seem to be composed of single rows of stakes but the spacing between stakes tends to vary substantially with some having spaces of more than 50 cm between individual stakes (see Figure 12) to others with spaces less than 10 cm (Figure 13). Some alignments appear to be two parallel rows of stakes separated by about 15 cm (see Figure 14). These features may reflect support stakes that once held lattice panels in position.

Stake spacing is undoubtedly influenced in part by differential preservation. Many alignments have gaps where stakes appear to be missing, possibly the result of erosion, or other disturbances. Where spacing patterns are very regular, however, as they often seemed to be, it is more difficult to imagine a taphonomic agent that would account for repetitively systematic intervals between large numbers of stakes.

Differences in stake spacing patterns almost certainly have important functional implications. As mentioned above, one of the relevant factors here is whether the stakes themselves formed a continuous fence or were combined with other devices such as lattice panels or even nets. Understanding the significance of stake spacing patterns will probably require consideration of how these patterns covary with alignment orientation relative to the channel, relationship to other alignments, depth in the intertidal zone, and other variables. At present these relationships seem much too complex to readily interpret.

Figure 11. Example of alignment with high density of spacing of stakes in a broad band. View is to southeast

Figure 12. Example of widely spaced alignment of single stakes.

Figure 13. Example of alignment with single stakes uniformly spaced at about 10 cm.

Figure 14. Example of parallel rows of stakes spaced roughly 15 cm apart.

3.2.4 VARIABILITY IN THE INDIVIDUAL STAKES

In sharp contrast to tidal fish weirs described for the Oregon coast (Byram and Erlandson 1996), the features at this site seem to be constructed primarily of split cedar stakes rather than branches. Stakes made from branches, although preferable for dating, proved to be difficult to find.

Although the portions of stakes that are buried in the mud seem remarkably well preserved, the portions that protrude above the mud are characteristically rotten. Most are heavily encrusted with barnacles and draped with marine algae as well so that the above-ground part of the stake offers little hint as to what the underground portion looks like. One exception to this generalization was an alignment composed of stakes with clearly rectangular tops protruding less than 10-cm out of the mud (Figure 15). The most plausible explanation for such well preserved stake ends would seem to be that they were rapidly buried in the mud and only recently exposed by erosion.

Figure 15. Stake alignments with well preserved, rectangular ends extending from mud. Stakes may have been buried rapidly and recently exposed by erosion.

Although only 10 stakes were collected during the present project, substantial variation in the depth that these penetrate into the mud is apparent (see Figure 16). Some extend less than 20 cm, others as much as 70 cm. Whether these differences reflect differences in sedimentation or some other factor is unclear. It is noteworthy, however, that the stake collected from the large nested V-shaped alignment was buried deeper than all others that were collected. Sharpening of this stake appeared to have been accomplished with a metal tool (see Figure 16, second stake from left) so its depth in the mud could reflect a difference in historic versus prehistoric construction techniques.

The height of most stakes above the mud ranged from 0 to more than 40 cm. In many features, stakes are barely visible above the surface of the mudflats, and in several instances stakes were felt in the mud that had no surface expression. The extent to which this site contains alignments that are totally buried and lacking in surface expression is unknown but it seems likely that a large number of stakes have no surface exposure at all. In contrast, stake height in certain features was as much as 60 cm from the ground surface, with many examples that extend more than 50 cm above the ground.

Figure 16. Stake samples (including both branch and split cedar) collected for radiometric dating. Stakes are arranged from No. 1 on the left to No. 10 on the right to correspond with numbers in text.

Differential preservation is undoubtedly a major factor influencing stake height observed in individual features. This inference derives from observations of some of the larger alignments that are more or less perpendicular to the channel of the slough. In such alignments, the stake height seems to be shorter on average toward the shallower portion of the intertidal zone. Inasmuch as frequency and duration of exposure to the atmosphere are factors that influence preservation of organic remains like wood, stakes higher in the intertidal might be expected to be less well preserved. This seems to be the case as stakes tended to be shorter in shallower areas within the intertidal zone—even within single stake alignments. Also consistent with this observation was an impression that most of the features with stake heights of more than 20-30 cm seemed to be relatively deep in the intertidal zone. An interesting question for future research is whether differences in stake height could be used as indicators of relative age for features at the same depth in the intertidal zone.

3.3 THE COLLECTED STAKE SAMPLES

In contrast to weir stakes that have been documented along the Oregon coastal estuary where most stakes are made from branches or stems (Byram 1998:210), the majority of stakes at the Newskah Creek site appear to be made from split cedar. In fact, in selecting a sample of stakes to collect for radiocarbon dating, an effort was made to find bark-bearing wood or stem-wood stakes and these proved to be relatively scarce.

Figure 16 shows the ten sample withes from the six sample location groups arranged left to right. Barnacles grow on the portion of the stakes exposed above the tidal mud flat. This figure documents the general morphology of weir stakes collected at Site 46GM83. Substantial variation is evident in length and depth of submersion in tidal flat mud (the barnacle-free section of the withes). Variation in submersion depth is probably an artifact of differential erosion of the tidal flats, rather than variation in the depth to which the stakes were initially placed, although the latter cause cannot be ruled out entirely. Once exposed above the mud, the stakes degrade quickly from biotic activity, accounting for much of the variation in length. Portions of the stakes continuously submerged in mud, however, were remarkably intact. Two of these clearly retained well-defined stone tool cut marks and one retained intact buds suggesting spring construction of the feature. Figure 17 shows striations interpreted as stone-tool cut marks at the mud-submerged distal end of branch wood Sample 3. Figure 18 shows less distinct, but comparable, cut marks at the distal end of Sample 5. Cut marks at the end of stake Sample 2 (Figure 19) appear to have been made with a metal ax, and accordingly, are assumed to substantially post-date other withes collected at the site.

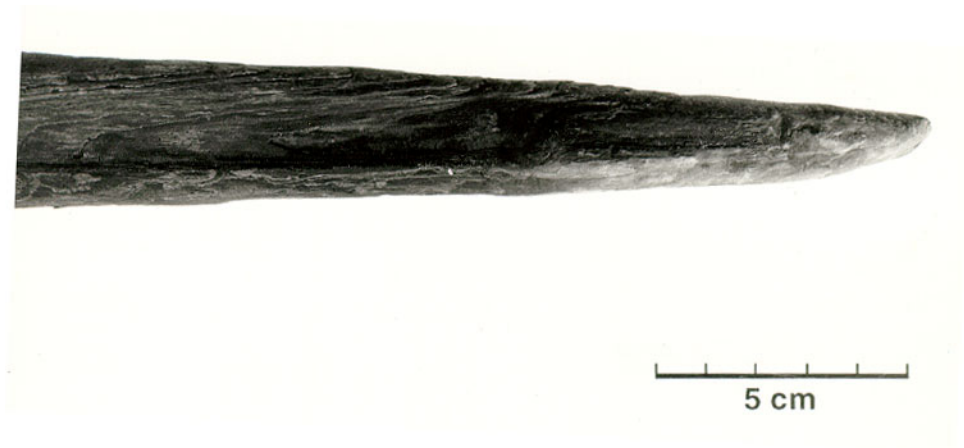

Figure 17. Distal end of Weir Stake Sample 2 showing weathered ax sharpened point.

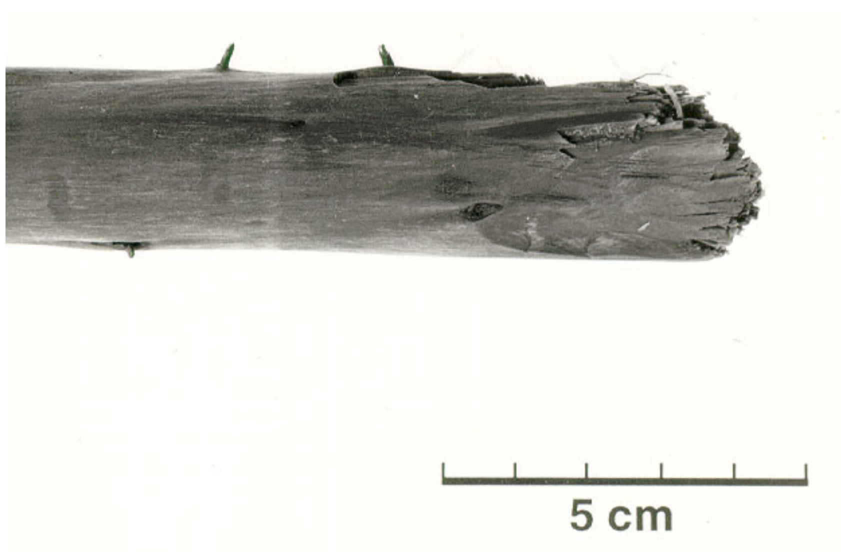

Figure 18. Multiple stone tool cut marks at the distal end of Weir Stake Sample 3.

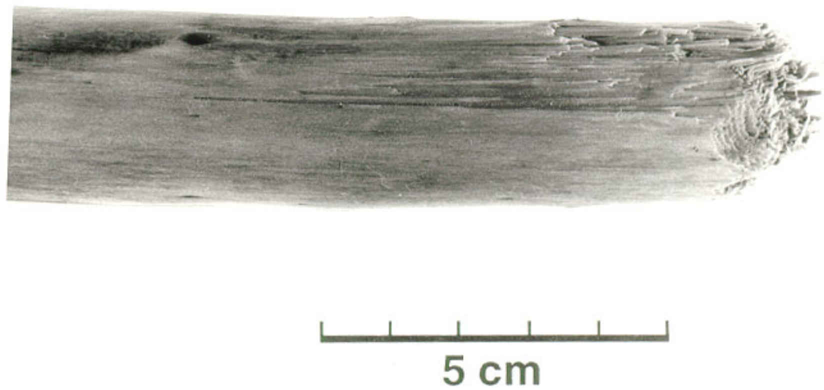

Figure 19. Stone tool cut marks on distal end of Weir Stake Sample 5.

Table 2 provides metric data on the lengths and diameter or cross section for each of the stakes collected in 1981 and 1999. Stakes range in length from 12 to nearly 100 cm. Although these variations in length are probably the result of differential preservation, they do indicate the substantial amount of variation in the depth to which different stake alignments are buried in the mudflats as noted above.

Diameters of the branch stakes in this series fall within a fairly narrow range between 1.8 and 3 cm. Cross sections of the split cedar stakes suggest that the stakes typically have rectangular cross sections of about 1.5 x 4 cm.

Table 2. Dimensions of Wood Stake Samples [1,2]

Artifact Number	Length (cm)	Diameter (cm)	Type of Wood
1999 Samples			
1	16.2	1.8	branch
2	99.5	3.2	branch
3	97	2.6	branch
	29.4	1.3 x 5.1	split cedar
4	42	1.8	branch
	47.2	1.7 x 4.1	split cedar (triangular X-section)
5	66	2.7	branch
	55.8	1.2 x 3.5	split cedar
6	33.1	4.0	branch
	29.8	1.4 x 1.4	split cedar
1981 Samples			
1A	65.1	2.4	branch
5A	56.6	2.8	split cedar
5B	82.4	3.0	branch with 3 adze marks
7A	52	2.2 x 3.4	slit cedar
7?	51.8	1.0 x 2.8	split cedar
7B,C, D, and E	---	---	disintegrating; tags not intact
A	91.6	3.2	branch (flattened tip; twigs cleanly sliced)
B	42.4	1.9 x 4.9	split cedar
C	35.8	1.4 x 4	split cedar
D	15.2	3.5	branch (fragment)
E	12.1	2.1 x 3	split cedar (fragment)

1 For each branch stake samples 3,4,5,6 collected in 1999, an adjacent split cedar stake was also collected from the same location. These are shown as unnumbered specimens beneath their respective branch specimens.

2 Field numbers assigned to five wood stake specimens that were collected in 1981 were destroyed by corrosion of the aluminum tags that were attached to them. These were given new letter designations and are listed at the bottom of this table (A-E).

3.4 HISTORIC PERIOD FEATURES

The site feature maps depict a series of piling features (see Figures 2-4). Unlike the wood stake features that are illustrated schematically, each individual piling is shown in these maps. Subsequent to the fieldwork, conversations with members of the Aberdeen Historical Society revealed that these pilings are the remians of commercial salmon fishing traps. According to a life-long resident of the area who was approximately 75 years of age, these pilings are the remains of commercial salmon fishing traps that had not been in use during his lifetime. Assuming that these features were originally built as fish traps in the late 1800s, it is still entirely possible if not likely that they were used subsequently for securing log rafts or moorage of boats. To the extent that either log rafts or watercraft were tied to these pilings during intervals of low tides, it is likely that these heavy objects would have crushed portions of wood stake features that extended above the mud.

The informant accounts for the use of these pilings are supported by another line of evidence. A 1911 map of water depth soundings for the South Channel area that includes the study area was obtained by David Rice from the Seattle District Corps of Engineers map collection. This map, prepared by the U.S. Coast and Geodetic Survey, shows a series of eleven linear features labeled as "fish traps" along the length of the south side of South Channel. These actually seem to extend well west of the western end of the prehistoric stake alignments although precise correlation of this old map with modern features was not possible. In addition to the eleven that are located along the southern margin of the South Channel, there is one on the north (Rennie Island) side of South Channel as well. It appears, therefore, that the piling features mapped along the South Channel during the present project are the remains of fish traps that operated during the early days of commercial fishing in this area. Their spatial congruence with the aboriginal fishing facilities is probably not coincidental. In all probability, this congruence reflects the importance of this specific locality for successful implementation of techniques that exploit a common set of prey species behavioral characteristics.

With the exception of the piling features, one other historic period feature was identified. This feature, located near the western end of the site (see Figure 20), consisted of dimensional lumber—paired 2x4s—spaced at 8-ft intervals. The function of this feature is less clearly related to trapping fish and it may represent a plank walk-way. In any case, this feature demonstrated that deterioration of the above-ground portions of wood masks the differences between sawn lumber and the split cedar stakes. It is possible if not likely, therefore, that some other historic features may be present on this site that were not recognized given the scope of this project and the size of this site.

3.5 OTHER ARTIFACTS

Corps of Engineers archaeologists collected a small number of artifacts from the site in 1981. This collection includes a ground stone maul, one clay (kaolin) pipe (see Figure 21), one piece of thick brown bottle glass (probable liquor bottle), a china plate fragment with "PMS Bavaria" on the bottom, and three wooden barrel staves (dimensions: 84.6 cm long; 1.7 cm thick; widths are variable ranging from 7.5 to 12 cm). Information on the exact proveniences of these artifacts within the site were not found among the project records but all of these artifacts are heavily encrusted with barnacles and were obviously collected from the surface of the mudflats. Since the western portion of the site was not identified at that time, these artifacts must have been recovered from the vicinity of the eastern stake alignments.

Figure 20. Paired stakes of dimensional lumber (2 x 4") spaced at 8 foot intervals.

Figure 21. Clay pipe and stone maul collected from the intertidal zone in 1981 during initial recording of the site.

The ground stone artifact has been shaped by pecking into a pestle-like form (see Figure 21). Use-wear on this artifact, however, suggests a hammering or pounding rather than a grinding function. Hence, it is referred to here as a maul. The large end has been flattened from pounding and this activity was forceful enough to have driven off a large flake from this portion of the tool. This artifact would be well suited to either driving stakes into the mud or for splitting the cedar stakes with a wedge, both activities that would have been associated with building and maintaining the fish traps.

3.6 RADIOCARBON DATES

One of the objectives of the project was to recover several wood stakes for radiocarbon dating. Ten stakes from six locations were collected for this purpose. Samples were collected from alignments that are widely separated spatially and at different elevations in the intertidal zone. This strategy was aimed at addressing the fundamental question of whether the entire site was a single set of contemporaneous features or a palimpsest of features that accumulated over a period of centuries or longer.

An effort was made to overcome the old wood problem in radiocarbon dating by selecting branch wood rather than split cedar stakes. Despite the predominance of split cedar in most features, a concerted effort was made to find branch wood stakes as these were viewed as preferred specimens ideally suited for reliable radiometric dates. Six branch wood stakes were collected and, for four of these, immediately adjacent split cedar stakes were also collected. The latter would allow comparison of results between radiocarbon dates on branch and split cedar, and hence, indicate the extent to which the old wood problem affects features at Site 45GH83 in the event funds become available for dating additional specimens.

A total of four branch wood specimens was submitted to Beta Analytic, Inc. for radiocarbon assay. Sample Locations 1, 3, 4 and 5 were selected to sample the site widely and represent both inland and water margin locations. Table 3 summarizes radiocarbon results. Interestingly, the two inland samples returned virtually identical ages at conventional 550 and 530 radiocarbon years B.P. respectively. Water marginal samples returned conventional ages of 960 and 930 B.P. While the sample size is too small for definitive inference, the patterns suggests 1) a relatively long temporal range for use of the Newskah Creek Fish Trap Complex, 2) multiple building episodes, and possibly 3) progressive construction from channel to inland margins of the site.

Table 3 Radiocarbon Dates from the Newskah Creek Fish Trap Complex

Field No.	**Lab. No.**	**Location**	**Sample Type (weight in grams[a])**	**Measured ^{14}C Age B.P. ±1σ**	**^{13}C / ^{12}C ‰**	**Conventional ^{14}C Age ±1σ**	**Calibrated Age(s)[b]**	**Calibrated Age Range** @ 1σ and 2σ
1	Beta 133558	Western, inland site margin south of ca. 1800W	branch wood, prob. *Thuja plicata* *(48.18)*	610±50	-27.8	550±50	B.P. 540 A.D. 1410	B.P. 620-519 / A.D. 1330-1431 B.P. 650-508 / A.D. 1300-1442
3	Beta 133559	West-central, low-tide water margin north of ca. 1575W	branch wood, prob. *Thuja plicata* *(35.22)*	950±50	-26.6	930±50	B.P. 884, 864, 827, 813, 798 A.D. 1066, 1086, 1123, 1137, 1152	B.P. 925-743 / A.D. 1025-1207 B.P. 950-695 / A.D. 1000-1255
4	Beta 133560	East-central, inland site margin north of ca. 1250W	branch wood, prob. *Thuja plicata* *(28.02)*	600±60	-29.4	530±60	B.P. 536 A.D. 1414	B.P. 619-512 / A.D. 1331-1438 B.P. 649-473 / A.D. 1301-1477
5	Beta 133561	Eastern, low-tide water margin north of ca. 1100W	branch wood, prob. *Thuja plicata* *(47.24)*	1040±50	-29.5	960±50	B.P. 916, 808, 802 A.D. 1034, 1142, 1148	B.P. 930-793 / A.D. 1020-1157 B.P. 959-737 / A.D. 991-1213

a Samples were cleaned and dried prior to weighing.

b Calibrated ages after Stuiver and Reimer (1993). Age ranges are calculated from intercepts of the radiocarbon age (Stuiver and Reimer's Method A).

Although the site form for Site 45GH83 suggested a protohistoric/historic age, the radiocarbon dates document that some of the stake alignments are roughly a thousand ^{14}C years old and that others were built or repaired at about 600 years ago. Considering that so few stakes were dated, these results strongly suggest that a larger series of dates would probably demonstrate a more continuous and possibly longer period of usage. Also, considering other chronological data available from the site (e.g., stakes apparently cut with metal tools, historic artifacts) that suggest historic period usage as well, it may be concluded that the site can in fact be considered a palimpsest of features spanning many centuries. A larger set of radiocarbon samples would be required to obtain the temporal control that would allow deciphering their functional relationships.

Some final comments are necessary regarding the four radiocarbon dates and the positions of the stake samples in the intertidal zone. The two oldest dates (Samples 3, 5) came from stakes recovered from the deepest part of the intertidal zone and, although deriving from features about 450 m apart, yielded essentially identical dates of about 1,000 ^{14}C years B.P. The two younger dates (Samples 1, 4) were obtained on stakes from features higher in the intertidal zone, also separated by more than 400 m; these too yielded statistically identical dates of about 600 ^{14}C years B.P. These patterns could be purely coincidental but nonetheless raise provocative questions to be addressed in future research. If seismic subsidence events altered the depths of fish traps in the intertidal zone, would traps have to be rebuilt after each event? If so, would this produce uniformity in the ages of stake alignments at similar depths in the intertidal zone?

4. DISCUSSION AND CONCLUSIONS

4.1 GENERAL SUMMARY

The Newskah Creek Fish Trap Complex contains a very large series of prehistoric and historic period fishing facilities distributed over approximately 80 acres of tideflats. Radiocarbon dates on wood stakes from the aboriginal structures document at least two prehistoric intervals of building or maintenance—the earlier at about 1,000 ^{14}C years B.P. and the more recent at about 600 ^{14}C years B.P. In view of the size of the site and the small number of radiocarbon dates, it seems highly likely that prehistoric usage of this locality was much more continuous than these dates might suggest. For the same reasons, the likelihood that still earlier stake alignments are present at this site also seems quite high.

A similar situation applies to the historic period. Usage of the site area during the last decades of the 19th century is demonstrated by the presence of several groups of pilings that represent the remains of commercial fishing traps of that era. An earlier period of historic usage is also hinted at by the presence of a very unusual V-shaped trap constructed of wood stakes. This feature is unique within this site and possibly also within the Northwest generally. A single wood stake that was recovered from this feature appeared to have been cut with a steel axe. If this is correct, it may be reasonable to interpret the age of this feature as falling somewhere in the interval between the late 18th century, when steel tools were first being used by indigenous people, and 1868 when the commercial traps were introduced.

In comparison to other intertidal fish trap or weir sites that have been described in the archaeological literature, Site 45GH83 appears to be unusual for the wide variety of construction techniques represented. The structural diversity in stake alignments within the Newskah Creek Complex argues strongly for functional diversity as well. Previous sections of this report attempted to identify some of the more obvious kinds of archaeological variability observed at this site—in positioning of alignments relative to the channel, in relationships between alignments, and in the spacing of stakes within the alignments. For specific features such as the V-shaped alignments that are situated with their open ends facing into the outgoing tide, it is not too difficult to visualize how fish could be funneled into basket traps. But for the majority of stake features, variations in their structural characteristics have yet to be explained.

Although explanation of how specific features operated and why so much variation exists in the details of their construction is not yet within reach, the general principles by which fishing structures located in this particular type of setting operated seem discernable. A powerful set of locational determinants must have operated in the selection of this site for fishing facilities over many centuries. The location of the weir features near the upper end of a slough conforms to a broader pattern in the positioning of such features that has been documented at other prehistoric weirs along the Northwest Coast (Byram and Erlandson 1996:52). For anadromous fish moving upstream or waiting for the appropriate water temperature conditions to initiate their freshwater migration, such locations offer good resting areas due to the lack of strong currents. The slackwater of a slough and the tendency of salmon to be delayed in their migration around the mouths of their spawning streams are both factors that would tend to concentrate fish at this type of locality. The final factor that is critical to understanding the strategic value of this location is the outgoing tide and how it serves to concentrate the fish even further. In the case of the Newskah site, the building of the late 19th century commercial fish traps at the same location as prehistoric fishing facilities suggests a set of shared environmental characteristics that made this vicinity attractive for both technologies.

The strong influence of these environmental factors on the siting of fish traps has an archaeological consequence of considerable importance and one that greatly complicates interpretation of such sites. The environmental factors that encourage repeated and long-term use of the same location result in the accumulation of an archaeological *palimpsest* in which features of various ages have been "overprinted". Byram (1998:202) has noted this problem relative to some Oregon coastal weir sites for which the "…identification of alignments has been frustrated by the presence of what appear to be overlapping structures." The magnitude of this problem for the Newskah Creek site probably cannot be emphasized too much. Highly labor intensive mapping of individual stakes combined with a very large series of radiocarbon dates will probably be necessary to begin to understand this complex archaeological palimpsest.

The depth of South Channel would preclude the building of fishing structures across the full width of the channel and, therefore, it is unlikely that the fishing structures at the Newskah site ever fully blocked fish from moving upstream. This is important because it relates to a functional distinction that is often made between fishing facilities that *block the upstream movement* of fish and those that *trap or strand* them on the outgoing tide (Byram 1998; Byram and Erlandson 1996; Moss and Erlandson 1998:180). Both types of fishing structures have been referred to as "weirs" (e.g., Byram 1998), but the term "trap" seems to be a more precise and, therefore, preferable as a descriptor of the kinds of fishing structures found at Newskah Creek. At the general level, all of these features probably served to catch fish on an outgoing tide by trapping them—not by blocking their passage upstream.

In considering variability in weirs and traps, Moss and Erlandson (1998:192) point out that

> Relatively few of the southeast Alaska weirs we know of appear to have functioned as dams crossing a stream from one bank to the other, even though

> this type is the most frequently illustrated in ethnographies (e.g., Emmon 1991). More commonly, they are linear arrangements of stakes that run at a variety of orientations to intertidal channels in estuaries that lead to streams. Many southeast Alaska weirs seem designed to entrap salmon as the salmon mill about in estuaries before ascending their natal streams. In this way, the weirs appear functionally similar to the semi-circular stone traps reported from southern British Columbia northward.

The location, structure, and orientation relative to the channel of the Newskah Creek stake alignments suggest that these features also functioned in a manner analogous to the stone traps of British Columbia.

Moss and Erlandson (1998) have also suggested that tectonic subsidence along the southern Northwest Coast may account for a major north-south contrast in the age estimates for weir features. All dated weir features on the southern Northwest Coast that have been dated have yielded age estimates of less than 2,500 years. In contrast, dates older than 2,500 years are relatively common on the northern coast. The hypothesis that this patterning is the result of preservation differences caused by subsidence along the southern coast has testable implications for the complex of fishing facilities at Newskah Creek. This hypothesis predicts that the oldest features should be lower in the intertidal zone than the more recent features. Despite the small number of features that were dated during the present project, the distribution of the dates is intriguing. The oldest radiocarbon dates are from deeper in the intertidal zone while the more recent dates are from features located in shallower portions of the intertidal zone. With so few dates, it is not yet possible to make too much of such patterns but nonetheless interesting to note that these dates do conform to the expectations of the subsidence hypothesis. Complicating this picture, however, is the presence of at least one probable historic feature (the large V-shaped trap) in the deepest part of the intertidal zone. And yet another important factor that must be considered in evaluating this hypothesis is the possibility that land level curves have exhibited a sawtooth effect cause by the intermittent occurrence of great earthquakes and the more relentless process of interseismic uplift (Atwater and Hemphill-Haley 1997).

4.2 DIRECTIONS FOR FURTHER RESEARCH

There are several avenues for further research that could not be pursued within the scope of the present project but that have potential to be rewarding.

4.2.1 AERIAL PHOTODOCUMENTATION

The intertidal zone is exceptionally well suited to the use of aerial photogrammetry for mapping features like those at Site 45GH83. However, for this technique to reliably represent the features currently visible across the site, it would be necessary to update available aerial imagery to accurately reflect *current* site conditions. If new aerial imagery could be obtained by scheduling the overflight to take advantage of the lowest tide of the year, a much more accurate and complete feature map could be produced for the entire site. The optimal combination of low tides and good light occurs in the months of June or July.

4.2.2 Radiometric Dating of Wood Stake Samples

Clearly, it would be very interesting to date a larger series of stakes selected strategically within the Newskah Creek complex. Systematic dating of more features would be especially helpful in terms of understanding which features are contemporaneous and which are not. This, in turn, is probably essential to interpreting how these features functioned. The spatial overprinting of structures of different ages has potential to obscure patterns in stake alignments that would otherwise be more easily interpreted.

Beyond purposefully seeking out branches or bark-bearing wood as part of future dating efforts, other considerations may be important as well. Sites like the Newskah Creek Fish Trap Complex dramatically demonstrate how long wood survives when immersed most of the time. Recognizing this, one would reasonably expect that a fish trap in such settings might have a long use-life, perhaps measurable in decades if not more. Rather than having to be rebuilt from one year to the next as was typically the case for true weirs ("fish fences") that blocked the channel of a salmon stream, tidal fish traps might have required only minor yearly maintenance such as replacing missing or broken stakes. If so, then it may be necessary to reconsider the frequently asserted relationship between features of this type and large labor forces necessary for their construction and maintenance. In any event, replacement of stakes during the use-life of a trap may be an important factor to consider in future sampling strategies used in retrieving wood for dating. It may be necessary to obtain many radiocarbon samples from *individual* features to gain insight into their use-life and how they were maintained.

4.2.3 Archaeological Survey of Other Intertidal Areas of Washington Estuaries

The environmental variables that influence the locations of functionally specific sites such as fish traps are often identified from survey data. The apparent clustering of stake alignments around the two creek mouths in the present study may hint at potentially important relationships that could best be examined with a larger data base on trap site locations. For example, if these traps were positioned to harvest fish returning to spawn in these small creeks rather than fish migrating up the Chehalis, then one might expect to find similar features at mouths of other creeks around Grays Harbor and Willapa Bay. Alternatively, if the distribution of fish trap features is conditioned more by channel morphology, the apparent association between stake alignments and creeks could prove coincidental. In any case, it would seem that an archaeological survey of the intertidal zone and associated landforms around Grays Harbor may have the capacity to recover substantial new information. The site inventory data would be useful for examining broader patterns in the relationship between trap sites and environmental variables. It would also be most interesting to see if there are significant differences in the morphology of trap features associated with different environmental and hydrographic settings.

Gilman (1998:275) has suggested that aerial surveys are useful for the discovery of archaeological remains in the intertidal zone. Even within the span of a single low tide, substantial portions of Grays Harbor could probably be canvassed from a low-flying aircraft. This reconnaissance could focus attention on areas for on-the-ground surveys and assist in prioritization of the inventory effort.

4.2.4 Archaeological Investigations of Upland Deposits

For lack of time, investigations of the archaeological deposits adjacent to the tidelands at Newskah Creek were not a part of the present effort. Assuming that remains of residential occupations associated with usage of the intertidal fishing facilities may be present, future investigations of these remains could prove informative. Whether such sites would have been positioned directly adjacent to the trap complex or at locations further removed is not clear. Previous attempts to identify upland archaeological remains in this general vicinity (Munsell 1976; 1977) have met with limited success.

If access to the fish traps in the prehistoric past was as difficult as it is today, then it is likely that people visited these facilities in canoes. Use of canoes would eliminate a difficult walk across the mudflats, allow efficient transport of fish removed from the traps, and facilitate exploitation of this location from a residential base sited upstream or even on the north side of the Chehalis River. In other words, it may be realistic to consider the possibility that the residential bases occupied during operation of the traps were located within a radius of a few miles of Newskah Creek. If so, information important for interpreting the trap complex might be obtained through investigations of other types of sites along this reach of the Chehalis River.

One of the more obvious questions that excavations of such deposits could address is the issue of what species of fish were taken with the weir features. Based partially on ethnography but also on the mesh size of the lattice fragments recovered from tidal weir sites, Byram (1998) maintains that a wide variety of fish was taken with these features. Some ethnographic sources suggest that weirs and traps were used mostly for salmon (Barnett 1955:79-80). Recovery of fish remains from archaeological locations where fish were processed and consumed offers the most direct means for gaining a better understanding of what species of fish were actually trapped. Upland sites adjacent to intertidal prehistoric stake alignments in Willapa Bay have yielded fish remains

(Atwater and Hemphill-Haley 1997) and it is reasonable to expect that uplands adjacent to or in the broader vicinity of Newskah Creek site could as well.

4.2.5 Archival Research

Additional archival and historical research would probably be particularly fruitful in terms of understanding the 19th and early 20th century fisheries in this area. James and Martino (1986) have identified several diaries of Grays Harbor area pioneers that could not be consulted within the scope of the present project. These sources may provide insights into historic period fisheries, especially fish traps that operated specifically in this area. There is likely to be much more information available on the historic period salmon trap fisheries for the Lower Columbia. Investigation of sources relating to that area could shed light on how the traps operated, and the environmental characteristics that influenced where these were sited. Such information could be useful in providing historical insights about the historic fish trap features at Newskah Creek that go well beyond the present study.

James and Martino (1986) consulted the unpublished ethnographic field notes of Thelma Adamson at the University of Washington archives for their study of Grays Harbor. Since their study was not specifically focused on fishing technology, it is possible that additional details on this subject could be retrieved from this source.

The Oregon Historical Society in Portland, the Washington State archives in Olympia, the Washington State Historic Society in Tacoma, and the Pacific Northwest Collection of the Suzzallo Library at the University of Washington are all worthy of examination for historical information and particularly historical photographs pertaining to the commercial fish trap industry.

4.3 MANAGEMENT RECOMMENDATIONS

4.3.1 National Register Eligibility

Due to its size, diversity, and integrity, the Newskah Creek Fish Trap Complex appears to be eligible for the National Register of Historic Places for its capacity "to yield information important in prehistory" (Criterion D, 36 CFR 60.6). Based on the published descriptions of other tidal fish traps in the Northwest, this site appears to be quite exceptional. Questions relating to how, when, and why subsistence systems like those that existed in the early 19th century on the Northwest Coast first developed are of central importance to the archaeology of this region. The emergence of settled village life supported by the bulk storage of salmon is generally linked to the usage of mass harvest fishing technologies. The wood stake features at Newskah Creek clearly have the potential to provide important new data relating to a large and diverse series of well preserved mass harvest fishing facilities. Future research at this site, therefore, has the potential to contribute important new information on the development of Northwest Coast subsistence systems.

Archaeological features at this site span an interval of a millenium or more. For this interval and possibly much longer, this site has demonstrated capacity to provide *chronological data* on specific forms of tidal fish traps. Because the features are constructed of wood stakes, virtually all of the features could be radiocarbon dated. Comparative analyses of stake features also offer the opportunity to obtain *technological data* on how the harvesting of fish in estuaries changed during the late prehistoric period in this region. Because these features were positioned where their effectiveness depended on maintenance of a specific elevational relationship with the tides, the history of their repositioning over the past thousand years may prove to be a useful source of data on the interaction of earthquake-induced subsidence and interseismic uplift for this region.

4.3.2 Recommendations

Proposed use of the area around the mouth of Newskah Creek for dredged material disposal in the 1980s was the impetus for Corps archaeologists to survey this locality in 1981. That survey resulted in the discovery of the Newskah Creek Fish Trap Complex. The proposal to use the area for dredged material disposal was subsequently cancelled. Consequently, the Corps has no further management responsibility for this site beyond documentation of the cultural resources investigations that have been carried out there previously. In the absence of a federal project and in consideration of the fact that the Corps does not own the property, future management of the Newskah Creek Fish Trap Complex is the responsibility of the property owner, the Port of Grays Harbor.

Given the fragility, size, complexity, and significance of this site, the development in the near future of a plan for the long-term management of this site is recommended. Such a plan would require information beyond that generated from the present study, but some of the issues that it should address can be identified.

Probably the most immediate management need is a better understanding of the natural and cultural processes that are affecting the site presently. Several lines of evidence from the 1999 survey suggested that there has been substantial erosion over large areas of this site since 1981 and probably much more recently than that. It is possible and perhaps quite likely that the site undergoes intermittent episodes of sedimentation and erosion. Sedimentation can be influenced by stake alignments associated with features like those at the Newskah Creek site (Putnam and Greiser 1993, cited in Moss and Erlandson 1998; see also Chaney 1998:262). Evidence of wood debris being caught in the stake alignments was readily apparent during the fieldwork at Newskah Creek. Such accumulations of flotsam in the stake alignments probably accentuate their sediment holding capacities. On the other hand, however, the Chehalis

River has a history of severe flooding. The massive scale of timber cutting in this watershed probably amplifies both large erosion-causing flood events as well as sedimentation. It would be risky to assume that because the fish trap remains have survived for centuries, they are not now threatened by a new set of conditions. The nature and extent of erosion and sedimentation at this site need to be documented for purposes of managing this cultural resource.

Other potential threats to the site relate directly to human activities. A management plan should address the issue of operating motorized watercraft within the site area. The fragile wood stake features are often at depths where propellers or boat hulls can damage them. Therefore, protecting the site's features from this type of impact will probably require exclusion of watercraft from the site area.

A related management issue is the use of pilings within the boundaries of the site for mooring watercraft, barges, or log rafts. Securing of watercraft or log rafts to those pilings that are in proximity to wood stake features clearly has potential to cause damage to the latter during low tides when such massive objects settle onto the surface of the mudflats. This would be particularly destructive where the stake alignments are in and around the piling structures. The very impressive and well-preserved nested V-shaped alignments run right through the group of pilings at 1880W and, therefore, are particularly vulnerable to this type of impact. These pilings should be signed as off-limits for tying of boats, barges, or rafts.

In consideration of the size, complexity, and fragility of this site, simply walking on it has the potential to damage delicate archaeological features. It is recommended that this area be closed to pedestrian access until such visitation can be controlled and directed in a way that will not cause impacts to the archaeological remains.

The management plan should include a plan for monitoring by professional archaeologists at regular intervals. Ideally this would be done at intervals of no more than 4-5 years and scheduled so as to coincide with the lowest tide of the year in June. Additional monitoring should be done after major flood events. The purpose of monitoring would be aimed at identification of any changes in site condition (e.g., erosion, sedimentation, vandalism, etc.). A series of observation points or monitoring stations should be distributed across the site to measure erosion and sedimentation.

Finally, the management plan should address how the site's interpretive potentials might be developed. Although it is only accessible for brief intervals during the lower tides of the year, the site has substantial interpretive potential. Any visitation to the site, however, must be mindful of the fact that the wood stakes are very fragile and that even walking across the site has potential to damage these remains. Therefore, public access to the site would have to be controlled and directed to insure protection of this unusual cultural resource.

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APPENDIX A.

WASHINGTON ARCHAEOLOGICAL INVENTORY FORM

U.S. ARMY CORPS OF ENGINEERS, SEATTLE DISTRICT

CULTURAL RESOURCES SITE SURVEY RECORD UPDATE

State: Washington *County:* Grays Harbor *Site Number:* 45GH73

1. *Type of Site:* Prehistoric/Historic tidal fish trap
2. *Name of Site/Previous Designation:* Newskah Creek fish weir
3. *Site Description:* Site consists of a series of roughly 170 wood stake alignments rising from the tide flats 10-60 cm over an area of approximately 80 acres. Several sets of large wood pilings are located along the length of the site as well and these apparently represent historic period commercial fish traps.
4. *Reference Map:* USGS Aberdeen Quadrangle (7.5 min. series) 1973.
5. *Location of Site:* South shore of Grays Harbor at the mouth of Newskah Creek and west along the shoreline on tidal flat.

   N1/2 NW1/4 *Section* 19, NE1/4 Section 24 *Township:* 17N *Range:* 9W W.M.
   U.T.M.: *Zone 10, N. 5,199,889.9* *E.* 434,858.6 *LAT.* *46°57′* *LONG.* *123°51′*
   Lambert: *State* WA *Zone* 2 *X.* 1,162,100.000 *Y.* 607,850.000
6. *Area of Occupation* *N-S:* 150 m *E-W:* *1,600 m*
7. *Depth and Character of Fill:* Surface stakes are present to a depth of 50 cm below surface. Matrix is a gray marine clay with occasional river deposited gravels.
8. *Terrain Features and Vegetation of Site and Surroundings:* Site is located on a tidal flac between a -3.0 and -1.0 foot elevation. No vegetation occurs on the flat. Adjacent uplands contain a mixed deciduous and coniferous forest (Sitka spruce) with a low understory of salmonberry and devils club.
9. *Previous Excavations:* No excavations have been carried out at the site. The site was originally recorded in 1980 by Corps of Engineers archaeologists. In June of 1999, International Archaeological Research Institute and Cascadia Archaeology mapped the site and collected a series of wood stakes for dating.
10. *Approach to Site:* Drive west on State Highway 105 ca. 3 miles from Chehalis River bridge at South Aberdeen. Turn right at Newskah Creek bridge and proceed north ca .5 miles on unimproved road. Leave car, walk west of railroad tracks across Newskah Creek, then directly north to shoreline. Site is visible only at low tides.
11. *Material Collected and Present Location:* During the 1999 site reconnaissance by the International Archaeological Research Institute and Cascadia Archaeology, 10 wood stakes were collected for radiocarbon dating. All collected materials are housed at the Seattle District, Army Corps of Engineers.

12 *Material Observed:* Fish trap remains – about 170 wood stake alignments - ranging in length between 10 and 150 m in length.

13. *Material Collected from Site by Others and Present Location:* Wooden stake samples from fish trap features, a stone maul, European clay pipe, glass dish and bottle fragments were collected during the original site visits by David Munsell in the 1980s. These materials are housed at the Seattle District, Corps of Engineers.

14. *Cultural affiliations:* Historically occupied by the Lower Chehalis. Radiocarbon dates indicate that some of the features were in use by about 1000 B.P. Groups of pilings are apparently date to the late 1800s.

15. *Owner and Address:* Port of Grays Harbor, State of Washington

    Attitude Toward Excavation: (P of GH) - cooperative

16. *Occupant and Address:* None.

17. *Informants and Addresses:* Bob Hermann, North Carolina.

18. *Previous Owners and Addresses:* NA

19. *Location of Photographs Taken:* USACE, Seattle.

20. *Recorded by:* Munsell/Storm *Date:* 8 June 1981

    Updated by: Schalk/Burtchard *Date:* 15 June 1999

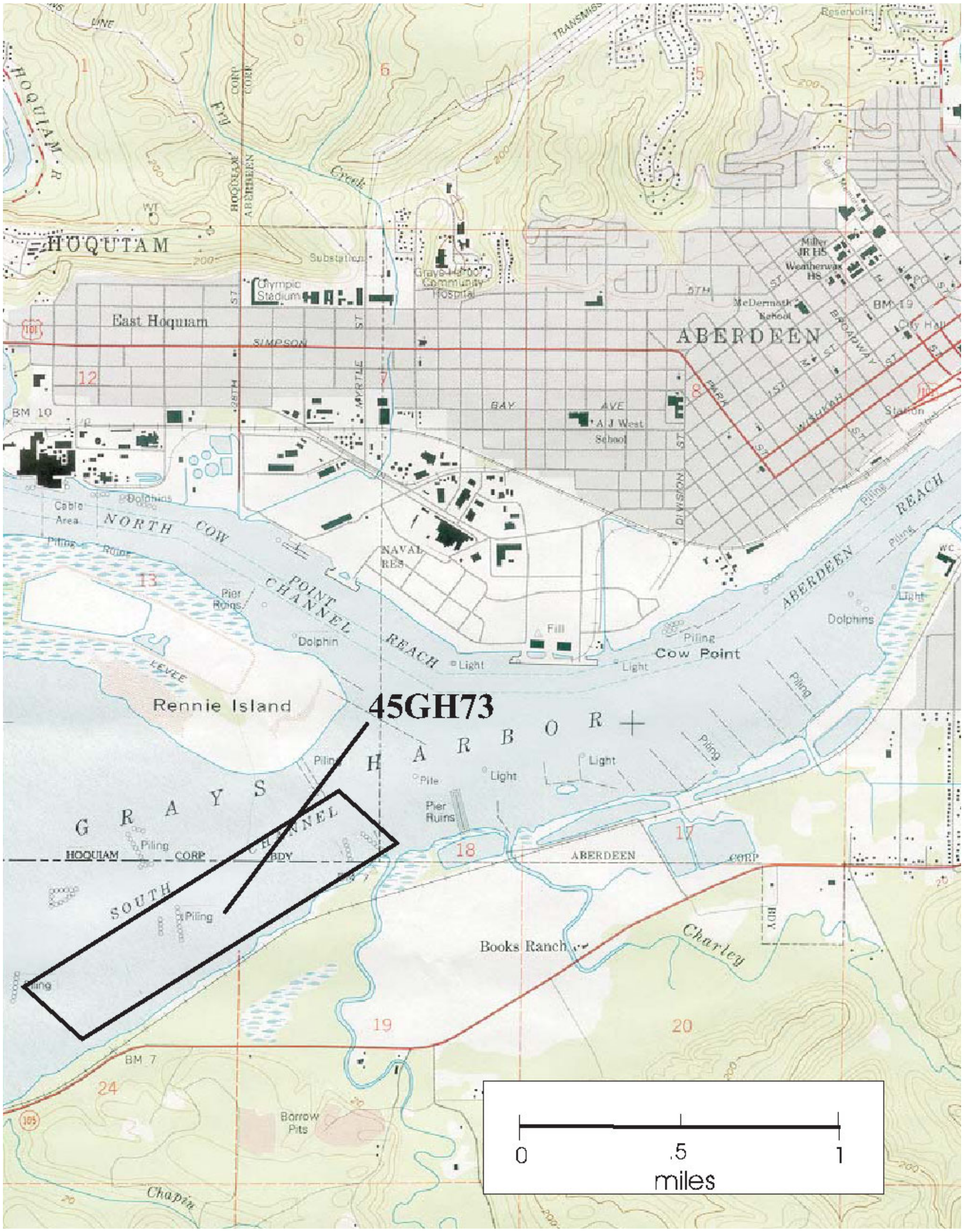
21. *Present Condition:* Excellent. Site is suffering from limited amount of degradation from marine animals and wave action. Siltation and erosion are both operative. Much of the western portion of the site was not identified when the site was first recorded in 1981 and the 1999 investigations suggested that the stake alignment features in this area of the site had been exposed by recent erosion events.

22. *Probability of Destruction:* Impossible to estimate but the site is clearly vulnerable to erosion and deposition events, wave action, and boating activities.

23. *Recommendation for Further Investigation:* Additional C-14 samples should be taken and assayed to understand the history of trap construction and possibly functional relationships between different alignments. Since only portions of the site were mapped in 1999, additional mapping and documentation of stake alignments should be completed. Ideally, this would be accomplished using a combination of photogrammetry (using recent aerial imagery) and on-the-ground documentation. Finally, the site should be monitored at regular intervals to identify any changes of condition or new management needs.

24. *Comments or Additions:* The walk to the site is hazardous - portions of the tidal flat are extremely water saturated and a person can easily mire to the knee. The safest approach is along Newskah Creek and along the shoreline.

25. Map of Site:



APPENDIX B.

UTM COORDINATES

Newskah Creek GPS, UTM Coordinates. [UTM Zone 10, Datum NAD 1927 (Western U.S.)]

GPS Location	Northing	Easting
Site Datum, mapped baseline point 1000W. Approximate eastern margin of visible weir features. (scattered stakes visible further east on both sides of Newskah Creek; sediments may obscure others.)	5199967.396	435069.314
Semi-circular wooden platform visible in 1981 aerial photos. Its center lies on the baseline 161.4 m grid west of Site Datum.	5199908.073	434915.437
Logging piling in mid-site area. GPS point is the most landward of a group of five smaller pilings inland changing to a double bank of pilings toward the channel.	5199806.695	434666.752
Logging piling near baseline 3 m east of 1800W. GPS is the first piling north of the eastern corner a “U” shaped group. Pilings extend as a single line both inland and toward channel from this group	5199671.945	434326.893
Site baseline point 2200W. The western-most extent of visible weir features in 1999.	5199522.032	433949.757